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Methodologies, Models, and Simulations Research for the Analysis of Stability Operations

75th Military Operations Research Society Symposium

13 June 2007

Purpose and Bottom Line

- **Purpose.**
  - **Present results of research efforts.**
    - **Research methodology.**
    - **Selection process and tool.**
    - **Viable methodologies, models, & simulations (MM&S).**
  - **Discussion/Q&A.**
- **Bottom Line.**
  - **Developed and applied a stability operations (SO) MM&S selection process and tool.**
  - **Developed a database of 30 applications.**
  - **Assessed and ranked them on functionality and utility.**

Agenda

- Background.
- Problem definition.
- Constraints, limitations and assumptions.
- Research methodology.
- Assessment cross-walk (issues, tasks, functionalities).
- Results.
  - Functionality assessment.
  - Utility assessment.
  - Relative ranking.
  - Application process.

Background

- TRADOC Standard Scenarios.
  - Corps/Division Southwest Asia Stability Operations scenario (SWA SO).
  - Bde Mega-City scenario.
- TRAC Stability Operations Functional Area Analysis (FAA).
- HQDA Stability, Security, Transition, and Reconstruction (SSTR) gap analysis.
  - TRAC and CAA partnership with HQDA to conduct Army capability and capacity gap analysis for SO functions.
- TRAC SO MM&S research.
  - What should we model?
  - What can't we model in our M&S?
- Future Combat Systems (FCS) Stability and Reconstruction Operations (S&RO) analysis for FY08 and beyond.
  - Identify the S&RO analytic issues.
  - Conduct S&RO first order comparative analysis between BCTs.
  - Conduct a model and data review and develop recommendations to enhance representation of phenomenon in the S&RO environment.

Problem Definition

- **Purpose of research/specified task: Determine usable MM&S to support the analysis of SO.**
- **Implied task for the research team: Examine existing MM&S to the degree that an assessment is possible in determining the utility of the MM&S for the intended analysis purpose.**
- **Accuracy of the answer. Deliverable(s) must have viable applicability in addressing issues of interest, emphasizing the capability of portraying cause and effect relationships.**
- **Research scope. Focus is on MM&S capability and utility in support of operational level SO analyses.**

Bauman's Law: Assess no model and compare no model to another model outside the context of its intended purpose and applications.

Constraints, Limitations, and Assumptions

- **Constraints.**
  - **Report complete by Apr 07.**
  - **Stability operations (SO) scenario development drove desired MM&S functionalities.**
  - **TRAC will not use a MM&S without access to underlying code and supporting data (no black box).**
- **Limitations.**
  - **Research effort is focused on MM&S that support operational level analyses.**
  - **Limited TRAC experience and knowledge of available SO MM&S; reliant on MM&S point of contact (POC) feedback on questionnaires and surveys. Must consider POC possible bias.**
  - **Research effort does not include a formal cost analysis.**
  - **MM&S capabilities assessed using potential issues (not actual study specific issues).**
  - **MM&S assessment based only on a subset of the tasks in the Functional Area Analysis for SO (i.e., original task list from SO scenario development).**
  - **The MM&S assessment did not include federated combinations of candidate MM&S.**
- **Assumptions.**
  - **MM&S POC responses/feedback are accurate and form a sufficient basis for the assessment.**
  - **Formal VV&A of every MM&S against both potential and current issues is too resource-intensive and is infeasible.**
  - **The SO scenario development issues and attendant tasks are reasonable sets to derive required MM&S functionalities.**

Research Methodology

- **Identify candidate MM&S; retained 26 of 30 for assessment.**
- **Assess functionality.**
  - **Stability operations scenario development.**
    - **Five Potential Issues.**
    - **Tasks in eight capability categories.**
  - **Identify required MM&S functionalities.**
    - **66 functionalities in support of 124 tasks.**
  - **Create and distribute functionality survey.**
  - **Synthesize input – create and apply selection tool.**
  - **Determine results (relative ranking) by issue and as a collective issue set.**
- **Assess utility.**
  - **Create and distribute utility questionnaire.**
    - **MM&S attributes (supportive of utility criteria).**
    - **Narrative assessment (eight capability categories).**
    - **Team rated POCs' narrative responses.**
  - **Apply utility criteria across candidate MM&S.**
- **Integrate survey results and determine relative rankings.**

Potential SO Issues

Issue #1 What Army and civilian personnel are required to conduct SO?

Issue #2* How does the Army develop a secure environment and transition security activities to host nation authorities?

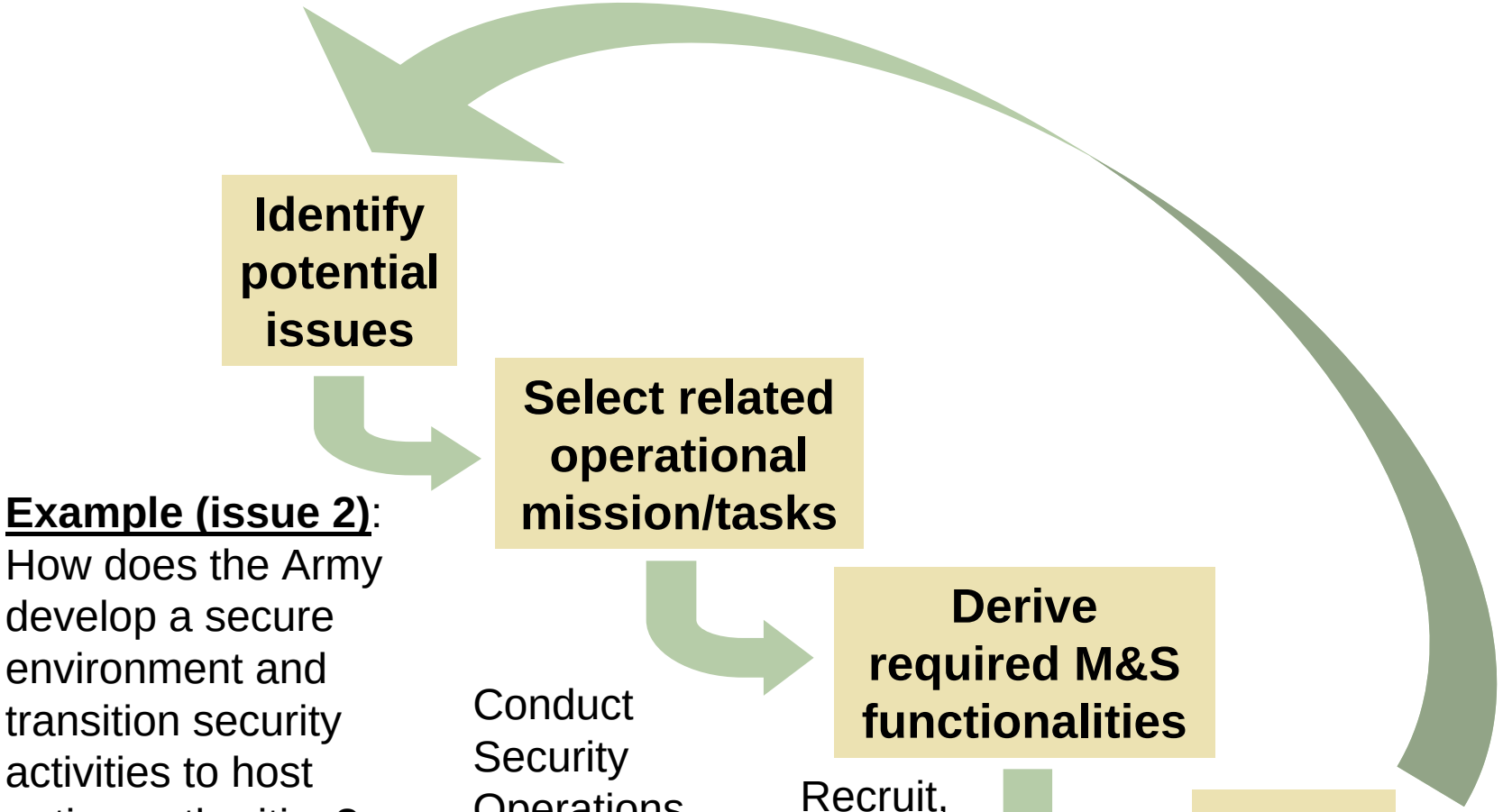
Issue #3 How can the Army share information with other government agencies, coalition forces, International Organizations, NGOs and host nation authorities supporting SO?

Issue #4 To what degree are Army, Corps, and Division staffs capable of commanding and controlling simultaneous combat and SO?

Issue #5 How does the Army evaluate host nation personnel?

***highlighted to illustrate assessment approach**

Assessment Approach: Functionality

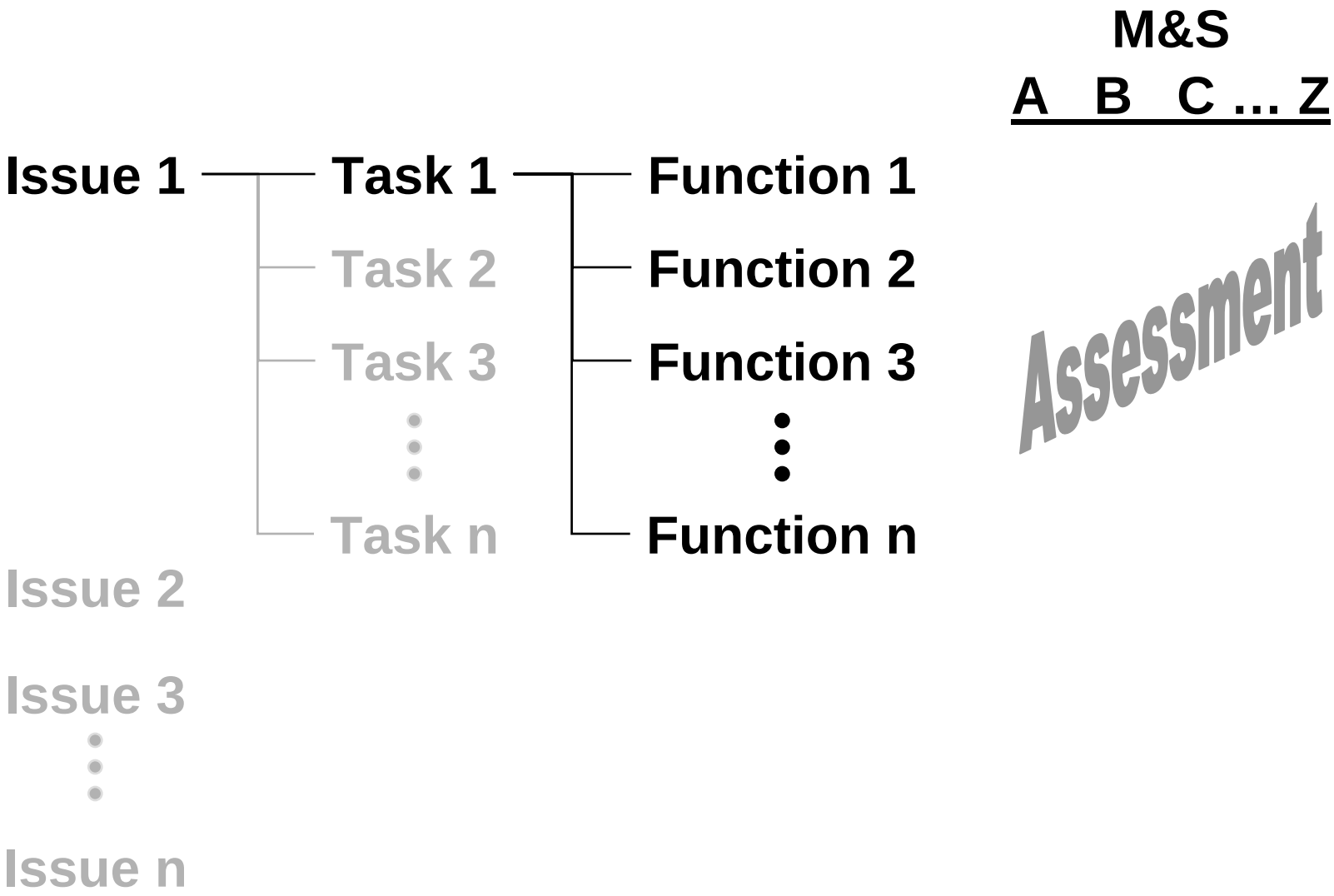


Example (issue 2):
How does the Army develop a secure environment and transition security activities to host nation authorities?

Conduct Security Operations

Recruit, train, and equip (model resources, time, and force structure changes) indigenous personnel

Functionality Assessment Cross-Walk



See spreadsheet

Spreadsheet Example 1 of 2

PotentialStudyIssueNumber	2				
PotentialStudyIssues	How does the Army develop a secure environment and transition security activities to host nation authorities?				
		Model_Number			
		Two		Twenty eight	
Task_Title	Model functionality	Model Score	Max score	Model Score	Max score
Conduct Security Operations	Coordination with EOD to clear areas of unexploded ordnance	0	4	1	4
	Determine and assign security for entities (including work teams and sites) at different force protection levels	1	4	4	4
	Effect of nominating and striking operational targets (e.g. insurgent elements) that are threatening the general population	4	4	4	4
	Entities consume resources depending on requirements (supplies, security, training and infrastructure)	2	4	4	4
	Establish Internment Camps/Prisons (manpower, training, and construction)	0	4	0	4
	Install and maintain a presence within neighborhoods to provide basic security until locals assume responsibility	4	4	0	4
	Monitor and respond to actions taken by indigenous groups against one another	0	4	1	4
	Portray capture and internment of key persons (leaders, criminals, etc) and effect on populace	0	4	0	4
	Portray different levels of Essential Services (SWEAT-MS)	3	4	0	4
	Portray different levels of SSTR support and effect on communities	2	4	0	4
	Portray simultaneous combat / stability ops and interactions	2	4	1	4
	Portray threat attempts to destabilize institutions	4	4	0	4
	Portray transition to indigenous security forces and effect on security operations	4	4	0	4
	Recruit, train, and equip (model resources, time, and force structure changes) indigenous personnel	4	4	0	4
	Seize, secure and dispose of weapons or other sensitive materiel	0	4	0	4
Conduct Security Operations Total		**30**	**60**	**15**	**60**
Provide EOD Support	Acquire or generate dynamic Terrain data	0	4	3	4
	Coordination with EOD to clear areas of unexploded ordnance	0	4	1	4
	Portray simultaneous combat / stability ops and interactions	2	4	1	4
	Seize, secure and dispose of weapons or other sensitive materiel	0	4	0	4
Provide EOD Support Total		**2**	**16**	**5**	**16**
Coordinate Host Nation Support		15	44	8	44
Essential services (SWEAT-MS): Security, Water, Electricity, Academics, Transportation Network, Medical, Sanitation (Trash and Sewage); need Academics, Tr		32	68	21	68
Resettle Refugees and Displaced Civilians		20	52	21	52
Assist Host Nation in Populace and Resource Control		26	112	25	112
Conduct Local Security Operations		23	60	24	60
Provide Protection for Operational Forces, Means and Non Combatants		26	56	21	56
Provide Protective Services for Selected Individuals		16	32	14	32
Conduct Internment Activities		13	32	10	32
Provide Refugee/Displaced Civilian Movement Control		5	32	17	32
Provide Support to Civil Law Enforcment		31	92	22	92
Provide Support to DOD and other governmental agencies		16	48	15	48
Determine National/Agency Capabilities and Limitations		16	32	15	32
Provide Support to Allies, Regional Governments, International Organizations or Groups		9	56	21	56
Conduct a Relief in Place		17	28	12	28
Identify/Transition logistical frameworkd for local security forces		27	56	22	56
Mark, Report and Record Obstacles		2	24	11	24
Establish and Conduct Coordination and Liaison		11	44	11	44
Coordinate plans with Non-DOD organizations		24	60	11	60
Perform Non Combatant Evacuation Operations		7	48	22	48
Advise Commander of Obligations to Civilian Population		27	60	16	60

Spreadsheet Example 2 of 2

		Model_Number			
		Two		Twenty eight	
Task_Title	Model functionality	Model Score	Max score	Model Score	Max score
Conduct Civil-Military Operations		27	68	14	68
Provide interface/liaisaon between US military forces and local authorities/NGOs		22	68	11	68
Conduct Foreign Internal Defense Operations		16	44	15	44
Provide Public Safety Support		16	52	15	52
Provide Law Enforcement and Prisoner Control		20	56	7	56
Coordinate Passive CBRNE Defense in the JOA		5	20	9	20
Conduct Attack on Operational Targets using Non-lethal means		7	24	21	24
Combat Terrorism in an AO		15	44	18	44
Provide NBC Protection to Friendly Forces		3	24	7	24
Integrate Host-Nation Security Forces and Means		14	24	4	24
Provide Operationally Significant Defenses		23	40	18	40
Combat operations (to address the simultaneity of SO and offense/defense) against organized armed resistance, down to individuals; patrolling; urban ops; non-l		18	92	67	92
Portrayal of levels of force protection		12	36	22	36
Conduct Electronic Attack		0	16	13	16
Provide Combat Assessment		8	28	20	28
Conduct Joint Force Targeting		6	32	29	32
Employ Close Air Support		4	20	20	20
Attack Operational Targets		6	36	30	36
Employ Fire Support Coordination Measures		11	32	20	32
Provide Intel Support to Civil-Military Operations		2	60	36	60
Communication with Non-English-Speaking Force and Agencies		13	44	10	44
Locate, tag, and track hostile elements; ISR		9	56	43	56
Conduct Combat Operations in Support of Foreign Internal Defense		15	48	31	48
Sharing of intelligence with security forces		2	44	27	44
Establish foreign disclosure program		4	20	10	20
Grand Total		673	2140	876	2140
		0.314		**0.409**	

Functionality Assessment Results

- **MM&S developers self-scored their abilities to address each functionality (0 - 4).**
- **Data reflects relative score ranking in addressing an issue.**
- **Total is a sum of issue scores (possible 5.0).**
- **Unweighted tasks, issues, and functionalities.**

Shaded – top 5

	Issues					
Model Number	*Personnel*	*Security*	*Information*	*C2*	*Host Nation*	*Total*
Fourteen	0.74	0.75	0.76	0.75	0.72	3.71
One	0.69	0.66	0.69	0.69	0.70	3.43
Twenty three	0.68	0.66	0.66	0.65	0.70	3.35
Twenty seven	0.65	0.70	0.64	0.69	0.65	3.33
Twenty one	0.63	0.63	0.58	0.64	0.64	3.13
Seventeen	0.57	0.56	0.56	0.54	0.57	2.79
Five	0.46	0.53	0.44	0.49	0.49	2.41
Twenty nine	0.42	0.53	0.48	0.45	0.48	2.37
Seven	0.46	0.46	0.41	0.44	0.42	2.19
Four	0.42	0.40	0.46	0.41	0.45	2.12
Thirteen	0.42	0.40	0.46	0.41	0.45	2.12
Twenty five	0.43	0.40	0.36	0.36	0.37	1.91
Twenty eight	0.40	0.41	0.28	0.43	0.33	1.85
Nineteen	0.32	0.32	0.32	0.32	0.33	1.61
Twelve	0.35	0.32	0.31	0.29	0.34	1.60
Two	0.30	0.31	0.27	0.28	0.34	1.50
Twenty six	0.26	0.33	0.26	0.27	0.29	1.41
Six	0.23	0.30	0.29	0.27	0.22	1.32
Twenty	0.25	0.16	0.24	0.19	0.19	1.02

Spreadsheet example

Utility Criteria

A. Capability to aggregate.
   - None to user defined.

B. Maturity.
   - Established track record.

C. Run time (real and/or faster than real time).

D. Data input requirements.
   - Number of variables and sources.

E. Required resources.
   - Personnel, training, HW/SW.

F. Output flexibility.
   - Standard/pre-built reports; user definable.

G. Availability.
   - Access, proprietary, acquisition (product or services).

H. Portrays public opinion and its relationship with other areas of the model.

I. Impact of political, military, economic, social, infrastructure, information (PMESII) interactions (on popular support).

Scoring based on 0 to 3 scale*

Stability operations-specific

*Higher is better

Utility Assessment Results

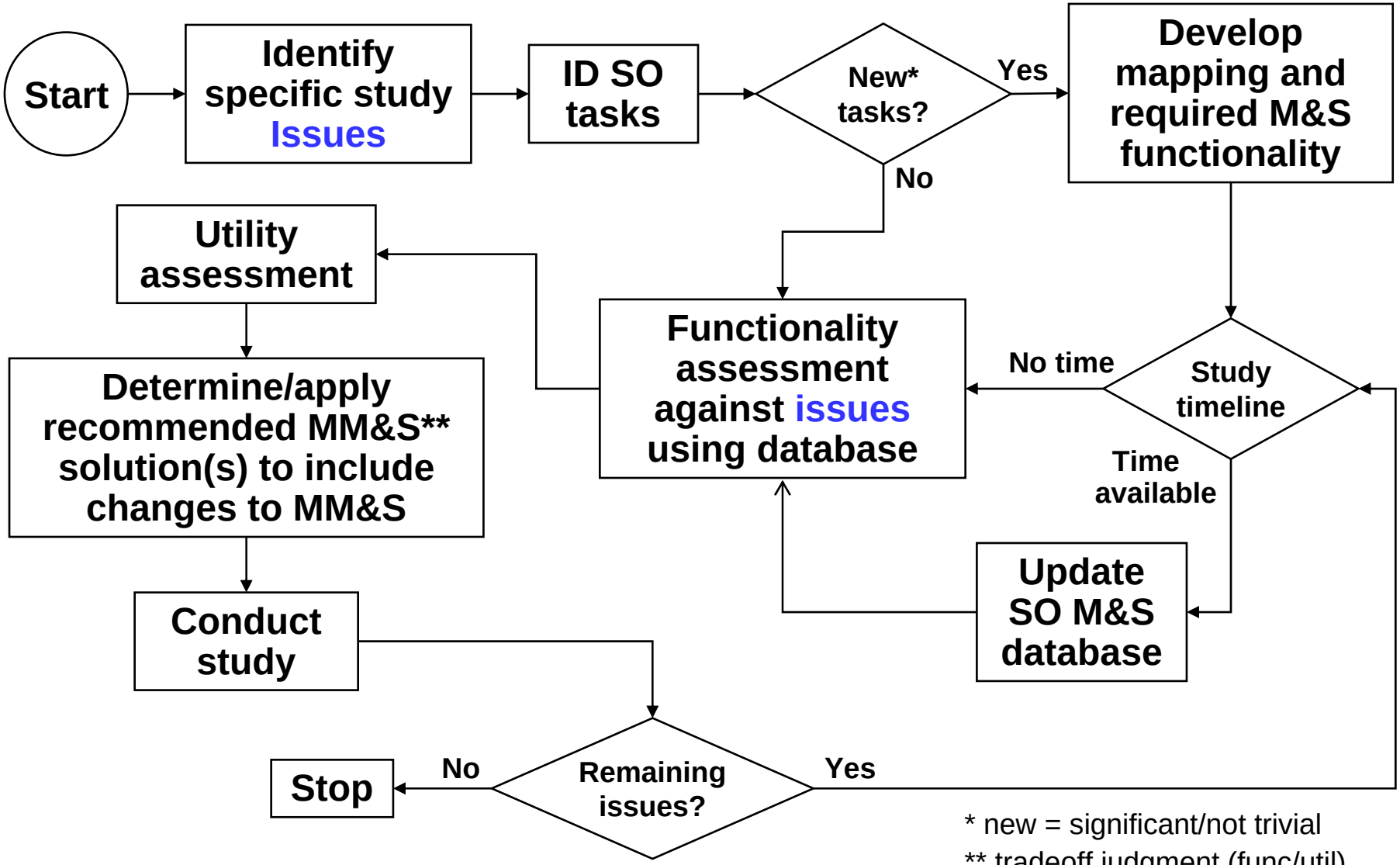
Shaded – top 5 M&S from functionality

Utility Criteria

	Model Number	*Agg*	*Mature*	*Run Time*	*Data*	*Res Reqd*	*Flex*	*Avail*	*Public Opin*	*PMESII*	*Total*
②	One	2	3	3	3	3	3	3	3	2	25
⑤	Twenty one	3	3	3	3	3	3	3	2	2	25
	Five	3	3	2	2	2	2	3	3	3	23
	Seventeen	3	3	3	1	2	3	3	3	2	23
	Twenty eight	3	3	3	3	2	3	3	0	1	21
	Seven	2	3	3	2	3	3	2	2	0	20
	Twelve	2	3	3	1	2	3	3	3	0	20
④	Twenty seven	2	3	2	2	2	3	3	3	0	20
③	Twenty three	3	3	2	2	1	3	1	3	2	20
	Two	3	2	2	2	2	1	3	3	2	20
	Thirteen	2	1	2	2	2	2	3	3	2	19
	Twenty five	2	3	1	2	2	3	3	3	0	19
	Twenty nine	3	1	3	1	3	2	2	2	2	19
	Nineteen	2	3	1	2	2	3	3	1	1	18
	Twenty	3	1	2	2	2	3	1	3	0	17
	Four	3	3	3	1	1	1	1	1	2	16
①	Fourteen	2	1	2	2	2	3	2	1	1	16
	Six	2	3	1	3	2	2	3	0	0	16
	Twenty six	1	3	1	2	2	1	1	1	1	13

Rank order of potential MM&S based on the total (unweighted).

Application Process and Selection Tool



SO~stability operations MM&S~methodologies, models & simulations

Summary / Way Ahead

- **Summary.**
  - **Developed and applied a stability operations methodology, model, and simulation (SO MM&S) selection process and tool.**
  - **Developed a database of 30 applications.**
  - **Assessed and ranked them on functionality and utility.**
- **Way Ahead.**
  - **Adopt/apply application process and selection tool in upcoming FY08 FCS stability operations (SO) analysis.**
  - **Maintain and regularly update database of SO MM&S.**
  - **Develop better understanding of highly ranked applications.**
  - **Investigate implementation options.**

Questions?